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ABSTRACT

The paper explains how Project LIFE (Language Improvement to Facilitate Education) has applied the principles of programed instruction in developing language materials for language handicapped children, especially the hearing impaired. Early strategy decisions are said to have involved obtaining a teaching machine which would be equipped with a four button response mode for discrimination frames and which would be capable of presenting programed language to hearing impaired children visually and auditorily. In the program's second stage, specialists in language, deaf education, and systems design are reported to have developed new strategy decisions in response to observations showing that hearing impaired children react favorably to programed instruction and colored art; that some children could not associate experience and symbols; and that some of the initial programs had no predetermined objectives or set levels of difficulty and complexity. Present programing is said to include behavioral analysis of objectives, planning for student responses, designing frames that challenge but do not overwhelm the child, and structuring materials to students' emotional and cognitive developmental levels. It is explained that program revisions are now made on data obtained from an average of 10 students per program, that the Program Master provides immediate confirmation and reinforcement for each correct response, that the programs are geared to individual differences, and that the programs are being validated at many field test centers. (GW)

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THE LIFE PROGRAMMING PROCESS

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THE LIFE PROGRAMMING PROCESS

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Waunita L. Garner

Much has been said and written about programmed instruction. This will not be a rehash of the history of programmed instruction. Instead it will explain how Project LIFE applies the principles of programmed instruction in developing language materials for language handicapped children, especially the hearing impaired.

IN THE BEGINNING

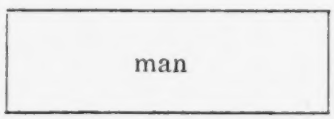
The original purpose of Project LIFE was to develop materials that would help the hearing impaired child acquire a receptive functional language system. Studies and investigations had shown that programmed instruction was effective in teaching language principles and vocabulary to the deaf. Researchers had also concluded that immediate knowledge of results after responding was important and that reinforcement had an immediate and profound effect upon learning and performance. Therefore, the early strategy decisions were to find or design a teaching machine that would give the deaf child immediate knowledge of results capable of presenting programmed language to the hearing impaired child visually (filmstrip or motion) and auditorily (sound through headphones). The machine should also have a

four-button response mode for discrimination frames.[1]

The target population for the beginning programmed materials was identified as hearing impaired children about six years old who possessed some awareness of language (both non-verbal and verbal), some communicative abilities but with little or no writing skills, and a readiness for formal language instruction. Only receptive language was to be programmed initially with expressive language added as soon as possible.[2]

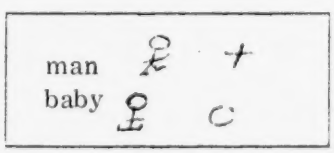
Several formats for teaching word recognition were developed and tried. The one adopted for the beginning materials was unique.

Frame 1 - Cue (word only)



Frame 2 - Prompt (association)

Frame 3 - Discrimination (based on memory)



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[1] Teacher's Manual of Project LIFE. Washington, D. C.: National Education Association, 1968.

[2] Wooden, H. Z. & L. I. Willard. "Project LIFE, Language Improvement to Facilitate Education of Hearing Impaired Children." American Annals of the Deaf 110, 1965. 541-52.

Five new words per lesson were presented consecutively to the child in this three-step procedure. The 15-frame cycle was repeated without the prompting frames. On the third cycle, all cue frames were dropped.[3] No response was required on the cue and prompt frames, only a button push to advance the frame.

Experimental programs, using the above format, were developed under contractual arrangements, at three programming centers: Ohio State University, Columbus; Our Lady of the Lake College, San Antonio, Texas; and the Rochester School for the Deaf, Rochester, New York.[4] These programming centers developed experimental programs based on a language outline compiled by leading educators of the deaf. Habitual present tense was used. Constructed response programs immediately followed the multiple-choice programs that presented the vocabulary and/or language principles involved.[5]

THE INTERIM

In 1968, the Project LIFE staff was enlarged and brought to Washington, D.C., to work under a team concept. The programmers and coordinators were a mixture of specialists in language, deaf education, and systems design (programmed instruction). Their first task was to "educate" each other in their various specialities.

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[3]Wooden, H. Z. "An Audiovisual Approach to Language Instruction of Children with Severe Hearing Impairments." Audiovisual Instruction 11, November, 1966.

[4]Ibid.

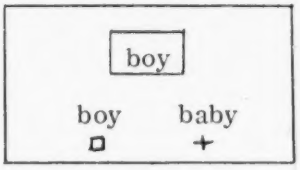
[5]Teacher's Manual of Project LIFE. Washington, D.C.: National Education Association, 1968.

The programmers were also testing the experimental programs with children on a one-to-one basis and recording the children's responses and reactions. Nine field test centers were also using the experimental programs. Observations from this testing by the programmers (later verified by the field test centers) were that:

> Hearing impaired children reacted favorably to programmed instruction and colored art.
>
> Some children could not associate experiences and symbols--they lacked inner language.
>
> Most children did not attend to the cue or prompt frames which presented only information and did not require a response.
>
> Programs had no pre-determined objectives.
>
> Programs varied greatly in levels of difficulty and complexity.
>
> A core of receptive language (visual input) which the child could carefully internalize was needed before expecting expressive language in written form.
>
> Habitual present tense was not the language the deaf child needed.
>
> The multi-channel Program Master was too complex--presented many difficulties.

New strategy decisions were made in January 1969. A new response device developed by the John Tracy Clinic which could be used with any standard remote control projector was adapted for Project LIFE. This necessitated the reshooting of filmstrips, which gave the Project the opportunity to correct mistakes made in the experimental programs. A new language plan was prepared to follow the Project's longstanding purposes and goals. The goal for the language programs remained the same: to provide a visual input of receptive language. Visual perception programs would be developed to precede the language programs.

New experimental formats requiring the child to respond to each frame were developed and tried with hearing impaired children. The basic seven-frame sequence which was used for the first two units of language began with a configuration match in the first frame.



The second frame was a cue frame requiring a non-verbal response. The new word and a visual was given. The student then had to discriminate between two visuals. To avoid misconception if a noun was being introduced, the activities in the stimulus and response visuals differed. For example, if the concept of boy was being introduced, the cued stimulus could be a visual of a boy sitting. The student would discriminate between visuals of a boy walking and a girl walking. If an action verb was being introduced, the persons or animals performing the activity in the stimulus and response visuals differed. For example, if the concept of is walking was being introduced, the cued stimulus could be a visual of a boy walking. In that case, the student would discriminate between visuals of a girl sitting and a girl walking.

The third frame in the sequence would be another cued frame (word and a different visual), requiring a verbal response. All cues were dropped in the fourth frame of the sequence. A non-verbal stimulus was used requiring a verbal response. The fifth frame was a reversal, a non-verbal response to a verbal stimulus. The sixth frame also required a non-verbal response, but different visuals and finer discriminations were used. The seventh frame was again a reversal.

This basic seven-frame format was used in the first two language units. It was modified as needed for the concepts taught in succeeding units.

AND NOW

The present LIFE programming process was implemented in February 1969. How are effective language programs for the hearing impaired developed? A simple recipe is:

Some hard work (behavioral analysis)

Add a liberal dash of imagination (student-centered programs designed to fit the needs of the child)

Mix with a lot of patience (validation)

Apply the principles of programmed instruction.

Behavioral Analysis

The programmer is assigned a unit. The language plan identifies the theme, the language principles, and concepts for each unit. The programmer's first task, then, is to make an analysis of what is to be taught and how best to teach it. Some considerations for the language programmer are:

Is a concept being introduced or expanded?

What language principles are involved?

How can these be made meaningful to the deaf child?

What sentence patterns and vocabulary can be used?

The programmer decides the purpose (what will be accomplished) and selects the new vocabulary for each section of the unit. Sequencing of sections within a unit

is as important as sequencing of frames within a section so that principles, concepts, and vocabulary introduced in one section can be reinforced or extended in subsequent sections.

Behavioral objectives are an important aspect of the behavioral analysis. Robert F. Mager once said, "If you're not sure where you're going, you're liable to end up someplace else and not even know it."[6] The programmers, after determining the WHY (purpose) of each section, predetermine the WHERE (behavioral objectives that clearly define terminal behaviors).[7] Objectives must be specific. The purist version of a behavioral objective requires three parts: the givens or the conditions required, the terminal behaviors clearly defined, and the criteria or standard of performance. Project LIFE uses a simplified version. (AUTHOR'S NOTE: Let's be realistic, don't most people?) The conditions are given only when they are unusual.[8]

An example of a typical purpose and objective for a language section is given below.

PURPOSE: To introduce the concept of to talk as speaking, shown visually by speech balloons, and to extend the concept of to have by using the past tense.

PROGRAMMED WORDS: had is/are talking

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[6]Mager, R. F. Preparing Instructional Objectives. Palo Alto, California: Fearon Publishers, 1962.

[7]Garner, W. L. "Behavioral Objectives." Newsline 1, Project LIFE, 1971.

[8]Garner, W. L. and C. E. Zerrip. "Evaluating Programmed Learning Materials." American Annals of the Deaf 116, 1971. 457-464.

BEHAVIORAL OBJECTIVE: The student:

a. Selects the visuals that correctly illustrate sentences containing the verb form had.

b. Chooses had to complete sentences identifying something no longer in the subject's possession.

c. Identifies the activity to talk and/or the persons speaking (shown visually by speech balloons).

It's not enough to know the WHY (purpose) and WHERE (objectives). The programmer needs a criteria for determining whether or not the students get there. To measure student attainment of the objectives, the programmer must design valid test items. Valid test items for the above objectives must measure had or is talking. An example of a poor test item for objective "a" might be:

The boy had an apple.

Picture of boy throwing away an apple core	Picture of boy holding a book	Picture of boy throwing away a piece of paper

The student in the above example may respond correctly without attending to had. Only one of the visuals contains an apple, so the controlling stimulus is apple instead of had. An example of a valid test item for the same objective might be:

The boy had an apple.

Picture of boy holding an apple	Picture of boy eating an apple	Picture of boy throwing away an apple core

In the above version, both the boy and the apple appear in all the visuals. The controlling stimulus, as specified in the objective, is had.

A valid test item for the "b" objective on the preceding page must measure had. The visual must show something no longer in someone's possession. For example, a balloon floating skyward, a crying baby reaching for it. The copy under the visual could be:

The baby _____.

has a balloon +
had a balloon ○
have a balloon △

If complete sentences were used, they would be most valid if they contained the nouns baby and balloon. The verbs contained in the complete sentences or verb phrases, in case of elliptical completion, should be different forms of to have and/or past tense forms of other verbs within the child's vocabulary.

When designing test items, the programmer must determine precisely what is to be measured and insure that that concept or principle is the controlling stimulus. The test items are invaluable developmental tools for the programmers. They serve as signposts to keep the programmer on the right track during the design process. They measure student attainment of the pre-determined objectives. They also pinpoint areas needing revision.

The unit analysis (purposes, listing of programmed words, and test items) is reviewed for validity and compatibility with the LIFE system. The programmer designs the unit materials after the analysis is approved.

Controlled Responses (Plan)

Planning an effective program is similar to planning a good lesson. First determine the purpose and objectives. Then determine what the student must do to

accomplish these objectives (responses). Then decide what you, the programmer, must do to get the student to make those responses (stimulus). That way the programmer controls the student's responses. Responses are relevant and bring the student nearer the objectives of the program. Through careful planning in the unit analysis (selective sequencing of concepts to be taught) and program design (logical sequential flow), the programmer can space review frames so they serve as transitional frames and further enhance the effectiveness of the program.

Optimum Step Size (Design)

How can you make programs interesting and thought-provoking (motivating)? Espich and Williams[9] say:

> The development of a smoothly-functioning program is an art. In order to become an artist, you must have certain prerequisite skills and knowledges. However, these qualities alone will not produce a work of art. A combination of the basic techniques and the individuality and the personality of the programmer is required to develop an interesting and functional program. Each program reflects its writer and his way of thinking, just as a novel gives some insight into the character of the author. Often the beginning programmer ignores this and concentrates too much on the technical development of the program. As a result, one of the basic pitfalls into which a new programmer blunders is the production of a mechanical, uninteresting program.

At LIFE, the programmers design frames that challenge, not overwhelm. They use a variety of discriminations. Concepts are developed with meaningful examples. They build an inter-relationship between frames (continuity and cohesion), through sequences or conversational chaining techniques. They program "thin" to avoid needless

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[9] Espich, J. E. & B. Williams. Developing Programmed Instructional Materials. Palo Alto, California: Fearon Publishers, 1967.

repetition. If the step size between frames is too small, the student becomes bored, inattentive. If the step size is too large, the program becomes frustrating. LIFE programmers aim for the happy medium. Developmental testing helps insure optimum step size for the "average" deaf child at each level.

Student-Centered Materials (Building)

LIFE materials are student-centered, designed to fit the needs of the child. The student must respond, covertly and overtly, to each frame. The guidelines given below are followed in the design and development process.

Introduce just one language principle or concept, based on the child's experiences, at a time.

Introduce new concepts in a simple, easy-to-understand way.

To insure meaning, introduce function words in phrases.

Use new words in sentences as soon as possible.

Have the student respond to thought units, sentences or phrases, so that the language programs are meaningful, not mere vocabulary drills.

Insure that there is only one correct response.

Expand new concepts by visuals and situations with which the child can relate.

Force the child to attend to and interact with the visuals and/or language to eliminate automatic responding (button pushing).

Provide meaningful repetition and a space review of concepts and principles until they are internalized.

Fade visuals after the concept or principle is internalized so that the child must interact with the language.

Build interesting, thought-provoking frames at the student's developmental level through careful response and foil selection. Foils may be grammatically incorrect, grammatically correct but not factually correct, or grammatically and factually correct but not relevant (as answers to questions).

Insure that the program progresses from the simple to more complex concepts in a logical, sequential flow toward the terminal behaviors (criterion frames similar to test items).

The draft of each program is reviewed for programming techniques, language, and compatibility with the LIFE system. When approved, type is set; then the program is assigned to an artist. Art (the visuals) is an integral part of the program design. During the developmental phase, the artist and programmer should function as a team.

Visuals should be attractive, yet simple and clear. They must appeal to the child. The critical elements should be clearly shown. Critical elements can be exaggerated in stylized art. LIFE uses a variety of art styles as a motivational device. Styles differ from section to section, but art within a section is of the same style. After the visuals are completed and approved, slides are shot for developmental testing.

Developmental Testing

Developmental testing is a very important part of the programmers' work at Project LIFE. The purpose of this testing is to increase the effectiveness of the programs. The programmer observes and records the responses and reactions to each frame. Later, the information is carefully analyzed. On the basis of the data obtained from an average of ten students per program, revisions are made. (Evaluation of developmental testing procedures at LIFE have shown a higher reliability to larger

group testing when the test sample is continuous.) Effective developmental testing includes a cycle of testing, revision, and retesting (if needed) until the program seems to meet the predetermined objectives. Developmental testing is essential for the programmers at Project LIFE. It enables them to see the programs through the eyes of the students and to make sure the programs accomplish the purposes for which they were developed.[10]

After developmental testing of each section within a unit, all test items for the unit are incorporated on one filmstrip. The test section serves as a diagnostic device and/or an evaluation instrument for the users of the LIFE materials. A typical language unit consists of a test section, six teaching sections, and supplemental materials such as programmed stories. The sections range from 40-60 frames.

Immediate Confirmation

The Program Master provides immediate confirmation and reinforcement for each correct response with a green light. The child cannot advance to the next frame until a correct response is made. Therefore, incorrect responses are not reinforced and thus extinguished.

Through design of the program, the student must attend to the critical elements of each frame and interact. The child is forced to make a decision. Many language impaired children are overly dependent, afraid to make a choice. When the child does make a choice and is successful, his reaction is a joy to observe. The green light, the immediate confirmation and reinforcement increases the child's

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[10]Lane, L.G. "Developmental Testing." Newsline 1, Project LIFE, 1971.

confidence, self-image. (AUTHOR'S NOTE: The child's reaction, in turn, provides reinforcement for the programmer, thereby increasing the programmer's confidence, self-image.)

Surprisingly, most children do not "button push" after the first programs. They do not want to make a mistake. If they do, they study the frame before making another choice. A psychologist observing the developmental testing at Carver School for the Deaf, Anne Arundel County, Maryland said, "It's a joy to watch learning taking place."

Planned Pacing

LIFE programs are geared to individual differences. If the test sections are used as diagnostic instruments, the students take only those programs they need. The student responds at his own rate, competes only with himself. His mistakes, if any, are his own.

Some test centers have used the LIFE materials for group instruction. Results of these experiments are available through the Research Department.

Validation

LIFE materials are being validated at many field test centers. The Research Department can supply this information.

POSTSCRIPT

LIFE programs are designed for children. They are developed by creative, intuitive programmers and artists under the guidance of "experts." These experts

are the children for whom the materials are designed. The principles of programmed instruction are educationally sound, as documented by many studies and expounded upon in many books. The LIFE rationale for any modification or interpretation of these principles in developing LIFE materials is THE CHILD and HIS REACTIONS to the materials.

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